Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

SMP46-12 会場:304 時間:5 月 25 日 14:30-14:45

300-400 ℃程度の石墨化度を示す炭質物のラマンスペクトルと反射率
Raman spectra and reflectances of carbonaceous matters showing graphitization temperatures at around 300 - 400 C

村田 雅美[1*], 佐藤　航[1], 星野 健一[2]
MURATA, Masami[1*], Wataru Sato[1], HOSHINO, Kenichi[2]

[1] 広島大学理学部, [2] 広島大学大学院理学研究科
[1]Fac. Sci., Hiroshima Univ., [2]Grad. Sch. Sci., Hiroshima Univ.

The degree of graphitization of carbonaceous matter (CM) has long been investigated using X-ray diffraction analyses, optical (reflectance) studies and Raman spectroscopies to analyze thermal histories of sedimentary rocks. Hirotaka and Hoshino (2007) noted that the degree of graphitization may reveal much detailed thermal histories than those recorded in the mineral assemblages. Komorek and Morga (2003) also demonstrated that the reflectances of CMs increased by only several hours heating in an oven. Therefore, we may expect the CM geothermometers for analyses of short-range thermal events such as dike intrusion, vein formation and faulting.

However, the thermometer using Raman spectrum of CM proposed by Beyssac et al. (2002) can be applied to the temperature range from 640 to 330 C with poor correlations at low temperatures. On the other hand, the thermometers by reflectance of CM ('vitrinite reflectance') are probably limited below 300 C (e.g., Hashimoto et al, 2004). Therefore, we have studied detailed characteristics of Raman spectra and reflectances of CMs showing their graphitization temperatures at around 300 - 400 C to investigate a future possibility of the CM geothermometer as a tool for analyses of the short-range thermal events.

We collected pelitic rock samples of the Kuga formation of the Jurassic accretion complex from the Yasaka contact aureole, Yamaguchi Prefecture, where the Hiroshima-type granite of the Cretaceous age intruded. Takami et al. (1993) classified the contact aureole into the cordierite zone (ca. $<$ 1 km from the contact) and the biotite zone (1 - 2 km wide). Takami and Nishimura (2000) mentioned that the apparent d002 of CM decreases sharply in the biotite zone at around 1 km from the contact.

Two types of CM can be identified under microscopic observations of the collected rock samples. Hereafter, we may call them temporarily as M-type and P-type CMs. The former shows visible reflection pleochroism as well as anisotropism, while the latter does non- or weak ones. Therefore, the P-type CM is probably collinite for so-called 'vitrinite reflectance' measurements. They can be identified clearly also by their Raman spectra. The G bands of the P-type CMs are broad, while those of the M-type are characteristically narrow and sharp. It is interesting that the P-type CM could not be observed in the samples collected from the vicinities of the contact with granite.

The R2 ratio of the Raman spectrum of the M-type CM shows a systematic change with a distance from the contact. It increases from 0.47 (= 430 C, estimated from the equation of Beyssac et al., 2002) at Loc. 03 (0.1 km away from the contact) to 0.60 (370 C) at Loc. 10 (2.4 km). On the other hand, although the ratio of the P-type CM is the highest as 0.77 (300 C) at Loc. 10, the ratio in the other samples closer to the contact does not vary with the distance and is stable as 0.75 (310 C), implying the lower limit of the ratio of the P-type CM.

The P-type CM from Loc. 10 shows the lowest reflectance as 3.8 % (= 320 C, from the equation of Barker, 1988), while those from the other localities are around 4.7 % (350 C) and show no significant variation with the distance, implying also the upper limit of the reflectance of the P-type CM. Although the reflectance of the M-type CM is slightly higher than that of the P-type CM in the sample from Loc. 10, no obvious difference between the two could be seen in the other samples.

It should be emphasized that there may be a size dependency of the M-type CM on its R2 ratio in the samples close to the boundary, that is, a smaller CM tends to show a higher temperature. Hence, it can be expected to apply the R2 ratio of the M-type CM not only as a thermometer but also as a 'chronometer' for short-range thermal events.

An estimation of a P-T condition of the vein-formation in the footwall of the Nobeoka thrust will be presented as an example of the analyses of the thermal events.

キーワード: 炭質物, ラマン, 反射率, 地質温度計
Keywords: carbonaceous matter, Raman, reflectance, geothermometer